

Terms, People, and Places

- Nicolaus Copernicus
- Heliocentric
- Galileo
- Francis Bacon
- Rene Descartes
- Scientific Method
- Hypothesis
- Isaac Newton
- Gravity
- Enlightenment
- Natural Laws
- John Locke
- Thomas Hobbes

Lesson Objectives:

- Explain how new discoveries in astronomy changed the way people viewed the universe
- Examine the Scientific Revolution, including the influence of Galileo and Newton
- Investigate the Enlightenment by comparing and contrasting the ideas expressed in *The Leviathan* and *The Second Treatise on Government*

Summary

“Scientific Revolution & Enlightenment”

Leaders of the Renaissance & the Reformation looked to the past for models. Humanists turned to ancient classical ideas. Religious reformers were inspired by the Bible & early Christian times. By contrast, the profound change that took place in science in the mid-1500's pointed ahead, toward a future shaped by a new way of thinking about the physical universe. We call that historical change the **Scientific Revolution**.

During the Scientific Revolution, amazing discoveries by individuals such as Copernicus, Newton, & Galileo changed the way Europeans viewed the physical world. This new way of thinking was based on experimentation & observation. This was the birth of modern science.

Scientific successes showed Europeans the power of human reason. could be used to study human behavior & solve society's problems. This prompted thinkers in the 1700s to use reason (investigation & observation) to discover **Natural laws** (rules discovered by reason & govern human behavior) to study human behavior * to solve societal problems. This way of thinking led to the **Enlightenment**, intellectual movement (using reason) introduced new ways of viewing authority, power, government, & law.

New Views of Universe

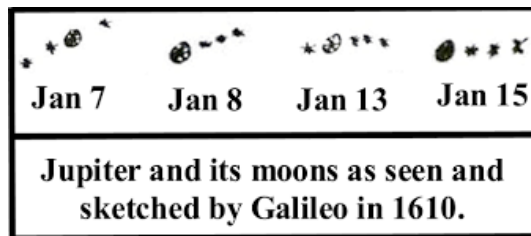
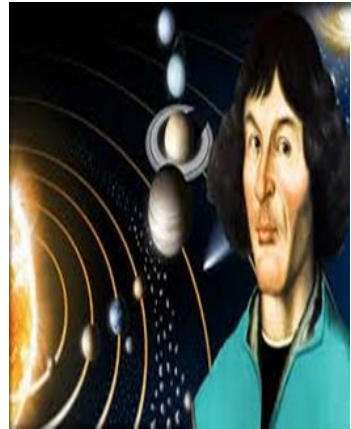
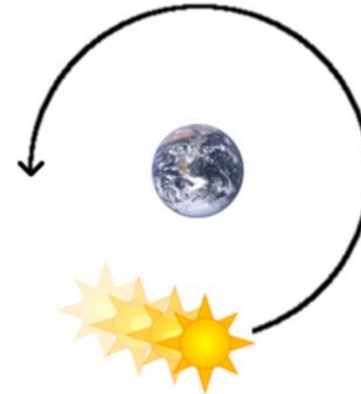
HELIOCENTRIC

Sun is the center. The earth has an orbit that rotates around the sun.



GEOCENTRIC

Earth is the center. The sun has an orbit that rotates around the earth.



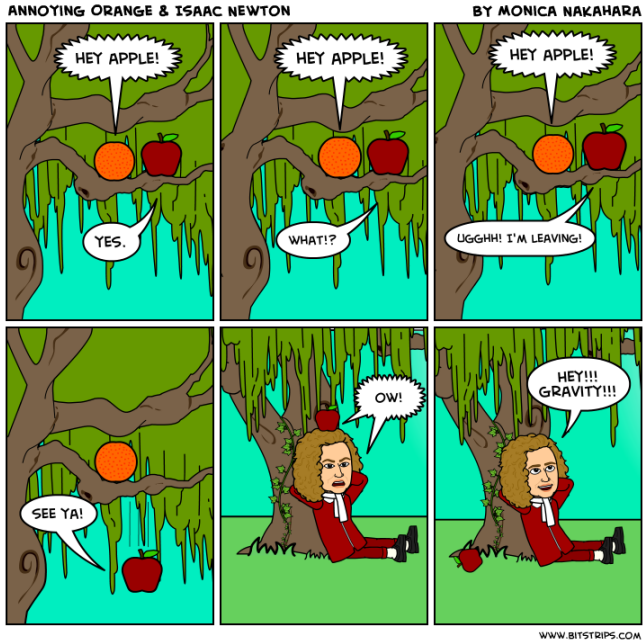
Copernicus' Supporters

- **Tycho Brahe** had evidence that supported Copernicus's theory
 - set up an observatory & carefully observed sky accumulating data about movement of heavenly bodies
- **Johannes Kepler** continued Brahe's work & calculated orbit of planets
 - his work supported heliocentric view but planets moved in oval shaped orbits not circles (ellipse)



Newton Ties It All Together

-
-
-
-



Law of Universal Gravitation

Every object in the Universe attracts every other object with a force directed along the line of centers for the two objects that is proportional to the product of their masses and inversely proportional to the square of the separation between the two objects.

$$F_g = G \frac{m_1 m_2}{r^2}$$

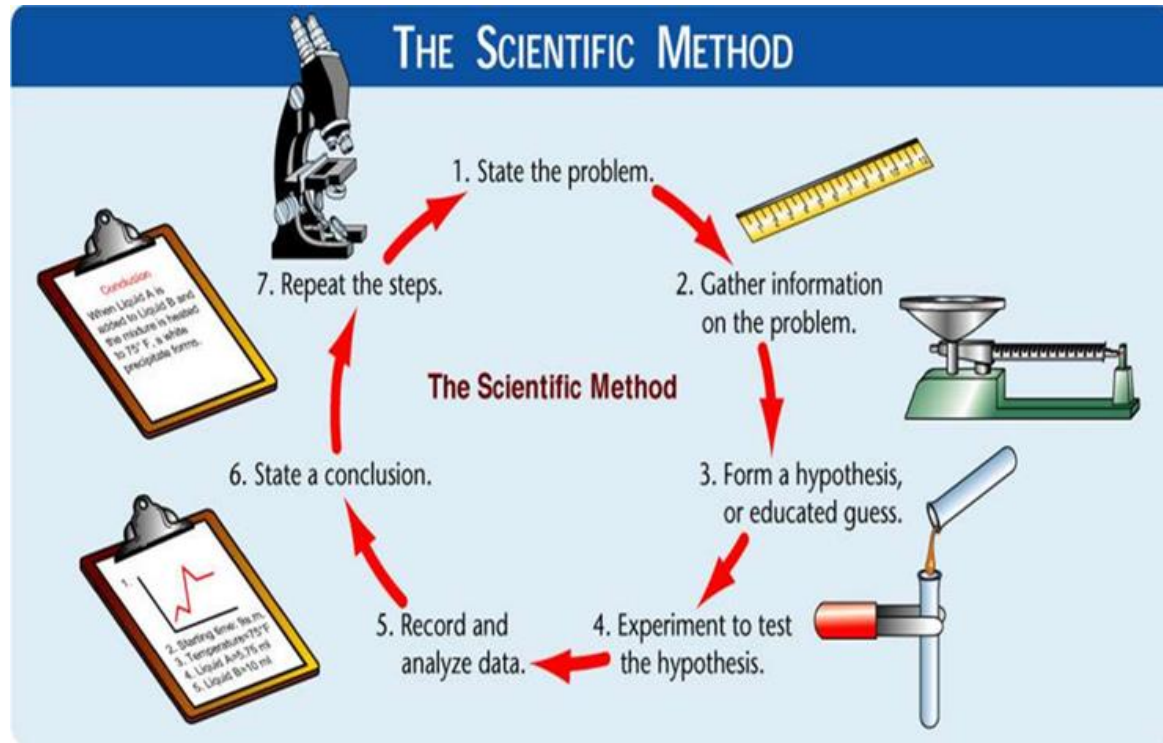
F_g is the gravitational force
 m_1 & m_2 are the masses of the two objects
 r is the separation between the objects
 G is the universal gravitational constant



Checkpoint

How did new discoveries in astronomy changed the way people viewed the universe?

Scientific Method



Revolutionary Thinkers



I think , therefore I
am



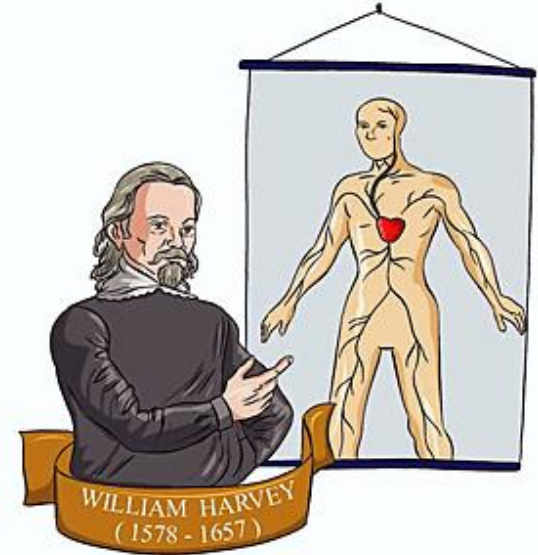
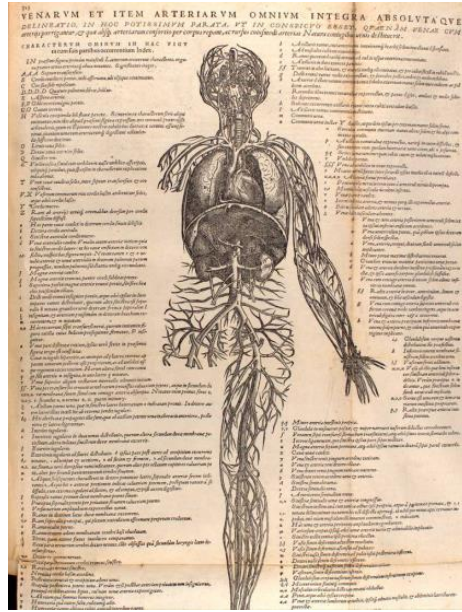
Checkpoint

How did the Scientific Method work?

Breakthroughs in Medicine

- **Andreas Vesalius**

- first accurate detailed study of human anatomy



- **William Harvey**

- first to describe circulation of blood
- heart pumps bloods

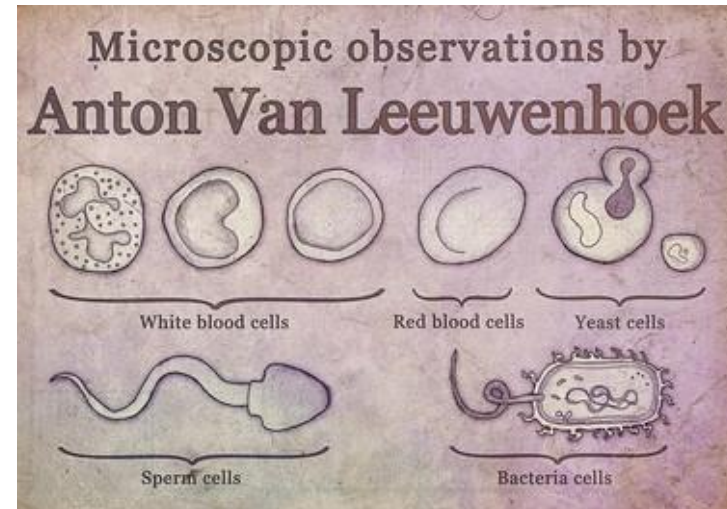
- **Anthony von Leeuwenhoek**

- first to see cells & microorganisms



- **Robert Boyle**

- pioneered chemistry
- Boyle's Law



Causes & Effects of the Scientific Revolution

Causes

- Medieval Intellectual Life & Medieval Universities
- The Italian Renaissance
- Renewed emphasis on mathematics
- Renaissance system of patronage
- Navigational problems of long sea voyages
- Better scientific instruments

Effects

- Rise of the “Scientific Community”
 - Royal Society of London (1662)
 - Academy of Royal Sciences (1666)
- The modern scientific method
- A universe ordered according to natural laws
- Laws discovered by human reason
- “De-Spiritualized” & de-mystified the Universe
- Mechanical View of the Universe

Effects of the Scientific Revolution

- **Positive Effects:**
 - We apply science & technology to everything we do
 - Without the intellectual theories of the Scientific Revolution, the world wouldn't be as developed
- **Negative Effects:**
 - Modern weapons that kill more people faster, wars, & colonial invasions



Checkpoint

How did the Scientific Revolution become practical?

Enlightenment- Age of Reason



Thinkers

Thomas Hobbes

-
-

John Locke

-
-
-
-



No arts; no letters; no society; and which is worst of all, continual fear and danger of violent death; and the life of man, solitary, poor, nasty, brutish, and short.

(Thomas Hobbes)

izquotes.com



The state of nature has a law of nature to govern it, which obliges every one: and reason, which is that law, teaches all mankind, who will but consult it, that being all equal and independent, no one ought to harm another in his life, health, liberty, or possessions.

(John Locke)



Thinkers

- Baron de Montesquieu



- Jean-Jacques Rousseau



- Voltaire



If the legislative and executive authorities are one institution, there will be no freedom. There won't be freedom anyway if the judiciary body is not separated from the legislative and executive authorities

~ Montesquieu ~



Man is born free and everywhere he is in chains.

~ Jean-Jacques Rousseau






AZ QUOTES







I disapprove of what you say, but will defend to the death your right to say it.

(Voltaire)

People of the Enlightenment -1600s & 1700s

Name	From	Wrote	Main Ideas
 Locke	England	Two Treatises on Gov't	-Observation: gov't exists to "preserve life, liberty, & property" -Hypothesis: people should be sovereign (rule) -Hypothesis: monarchs not chosen by God
 Hobbes	England	Leviathan	-Observation: Life without gov't is "solitary, poor, nasty, brutish, & short." -Hypothesis: Absolute gov't needed to control evil behavior (not divine right)
 Montesquieu	France	The Spirit of Laws	-Observation: "When the legislature & executive are united in the same person, there is no liberty (freedom)" -Hypothesis: Gov't must have " <i>Separation of Powers</i> " -- 3 branches
 Rousseau	France	The Social Contract	-Observation: "man is born free, but everywhere he is in chains." - Hypothesis: Gov't is contract between people & rulers. Gov't must be what people want.
 Voltaire	France		-Observation: Life is better with liberty -Hypothesis: Freedom of speech & religion, separation of church & state -"I disapprove of what you say, but I will defend to the death your right to say it. "

Thinker	From	Wrote	Main Ideas	Famous Quotes
 <p>Hobbes</p>	England	<i>Leviathan</i> , 1651	<p>Social Chaos</p> <p>Men are selfish and competitive</p> <p>Life without government is “solitary, poor, nasty, brutish, and short”</p> <p>Give all power to absolute government to control evil behavior</p>	<p>“The right of nature...is the liberty each man hath to use his own power, as he will himself, for the preservation of his own nature; that is to say, of his own life.”</p> <p>“The only way to erect such a common power which may defend them...is to confer all their power and strength upon one man...”</p>
 <p>Locke</p>	England	<i>Two Treatises on Government</i> , 1689	<p>Every man has 3 natural rights: life, liberty, and property</p> <p>Government exists to preserve natural rights</p> <p>People agree to give up some of their rights for the sake of preserving society (social contract) but have the right to rebel</p> <p>Republic is the best form of government</p>	<p>“All mankind...being equal and independent, no one ought to harm another in his life, health, liberty, or possession.”</p> <p>“Political power is that power which every man...has given up into the hands of society...”</p>
 <p>Montesquieu</p>	France	<i>The Spirit of Laws</i> , 1748	<p>Government must have a separation of powers (3 branches: executive, legislative & judicial) to ensure freedom & liberty</p> <p>Checks & balances</p>	<p>“When the legislature & executive are united in the same person...there can be no liberty...”</p> <p>“Power should be a check to power.”</p>
 <p>Rousseau</p>	France	<i>The Social Contract</i> , 1762	<p>Establishment of government is a social contract between the people and the ruler(s)</p> <p>Invest all rights into society (“general will”)</p> <p>The government must preserve “virtue” and “liberty” or the people will overthrow it</p>	<p>“We, the contracting parties, do jointly and severally submit our persons and abilities to the supreme direction of the general will of all...”</p> <p>“Man is born free, but everywhere he is in chains.”</p>



Checkpoint

What reforms did Enlightenment thinkers want to bring to government?